**ANNEX B OF CMO NO. 20, SERIES OF 2015**
**BACHELOR OF SCIENCE IN MARINE ENGINEERING**
**COURSE SPECIFICATIONS**

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| **Course Code** | **:** | Maint |
| **Course Descriptive Title** | **:** | Maintenance and Repair |
| **Course Credits** | **:** | 3 units |
| **Lecture Contact Hours per Week** | **:** | 2 hour |
| **Laboratory Contact Hours per Week** | **:** | 3 hours |
| **Prerequisite** | **:** | Engineering Materials |
| **Reference/s** | **:** | 1.STCW Table A-III/1, III/2 and III/5<br>2.IMO Model Courses 7.02 and 7.04<br>3.Annex A of CMO 20, series of 2015 (Curriculum Mapping)<br>4.STCW'78 as amended |

| COMPETENCE | KNOWLEDGE, UNDERSTANDING AND PROFICIENCY | PERFORMANCE | APPROX HOURS |
|---|---|---|---|
| Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board | Methods for carrying out safe emergency/ temporary repairs | – Explains what is meant by an emergency/temporary repair<br>– Explains the differences between an emergency/temporary repair and a permanent repair<br>– Explains what should be taken into account when carrying out emergency/temporary repair<br>– Explains how to carry out emergency/temporary repairs in accordance with situations<br>– and materials<br>– Explains what sort of materials can be used for emergency/temporary repairs of pipings<br>– Explains what sort of materials can be used for emergency/temporary repairs of valves<br>– Explains what sort of materials can be used for emergency/temporary repairs of coolers<br>– Explains what sort of materials can be used for emergency/temporary repairs of boiler smoke tubes<br>– Explains methods for emergency/temporary repairs of overboard/seawater suction valves in case of leaking.<br>– Explains how to replace overboard/sea water suction valves under afloat condition | 5 hrs |
| Maintenance and repair of shipboard machinery equipment | Safety measures to be taken for repair and maintenance including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment | – States that a well-organized work shop must be most effective to ensure a safe working environment and for using hand tools, machine tools and measuring instruments<br>– States the importance that all the tools and measuring instrument should be kept in good order and shape to avoid accidents and to ensure safety of life<br>– States that proper use of tools enables successful completion of the tasks<br>– States the importance that a careful attitude is necessary when working on any tasks<br>– States that first-aid box, fire extinguishers, appropriate lighting and ventilation should be in the work shop<br>– Describes the necessary control over the power supply to a machine tool<br>– Describes the basic differences between 'stop' and 'start' buttons<br>– Describes the purpose and siting of 'emergency stop' buttons<br>– Describes the situations where the following should be worn:<br>– safety helmets | 5 hrs |

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|---|---|---|---|
| | | – eye protection<br>– protective footwear<br>– skin protection<br>– States when hands and arms should be washed with soap and water<br>– Describes the care necessary for hands, including for any cuts or abrasions | |
| Maintenance and repair of shipboard machinery equipment | Appropriate basic mechanical knowledge and skills | – States that knowledge concerned in operation mechanism and construction of machinery equipment depending on Function 1 has to be necessary to carry out maintenance and repair (Refer to function 1)<br>– States that details of the construction of intended machinery/equipment/components have to be confirmed with their drawings/instruction books before working on the tasks<br>– States that understanding/interpretation of drawings and instruction books is required to carry out maintenance and repair | 5 hrs |
| Maintenance and repair of shipboard machinery equipment | Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment (Reduced number of hours, also covered by the Cadetship period) | **Fastening**<br><br>– Identifies types of threaded fastener<br>– States that bolts/nuts should be equally tightened in correct sequence when fastening plates/blocks with more than two bolts/nuts<br>– Explains why studs are used<br>**(Supervised student activity)**<br>– Fits studs and bolts and uses correct tightening procedures<br>– Removes studs (intact and broken) and split nuts<br>– Demonstrates how to protect finished surfaces<br><br>**Centrifugal Pumps**<br><br>**(Supervised student activity)**<br>– Dismantles:<br>– casing<br>– impeller<br>– wear rings<br>– shaft<br>– bearings<br>– gland/seal<br>– air pump | 55 hrs |

| COMPETENCE | KNOWLEDGE, UNDERSTANDING AND PROFICIENCY | PERFORMANCE | APPROX HOURS |
|---|---|---|---|
| Maintenance and repair of shipboard machinery equipment (cont.) | Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment (Reduced number of hours, also covered by the Cadetship period) (cont.) | – float chamber<br>– Examines and measures all parts for wear and deterioration<br>–Re-fits, checking, clearances<br>–Replaces and adjusts seals<br><br>**Reciprocating Pumps**<br>**(Supervised student activity)**<br>– Dismantles:<br>o cylinders<br>o piston/buckets<br>o rings<br>o valves<br>o joins<br>o glands<br>o relief valves<br>– Measures wear in cylinders, neck rings and rods; checks ring gaps<br>– Machines and/or grinds in valves and seats<br>– Removes gland packing<br>– Selects and fits new gland packing<br><br>**Screw and Gear Pumps**<br>**(Supervised student activity)**<br>– Dismantles:<br>o rotors and gears<br>o seals<br>o bearings<br><br>o relief valve<br>– Examines for wear and deterioration<br>– Reassemble, checking end clearances and backlash<br>– Replaces and adjusts seals<br><br>**Valves**<br>**(Supervised student activity)**<br>The followings are applied to typical stop valves and safety/relief valves:<br>o Examines seats, valves, spindles, glands | |

| COMPETENCE | KNOWLEDGE, UNDERSTANDING AND PROFICIENCY | PERFORMANCE | APPROX HOURS |
|---|---|---|---|
| Maintenance and repair of shipboard machinery equipment (cont.) | Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment (Reduced number of hours, also covered by the Cadetship period) (cont.) | ○ Machine valves and seats<br>○ Beds in valves on seats, using grinding paste<br>○ Removes old gland packing<br>○ Selects correct gland packing<br>○ Repacks glands<br>○ Tests<br><br>**Air Compressors**<br>**(Supervised student activity)**<br>– Dismantles, examines and replaces or repairs as found necessary:<br>○ suction and delivery valves and seats<br>○ piston and rings<br>○ glands/seals<br>○ relief valves and bursting discs<br>○ coolers and cooling passages<br>○ lubricating oil system<br>○ drains<br><br>**Heat Exchangers**<br>**(Supervised student activity)**<br>–Dismantles and examines:<br>○ for leakage<br>○ for corrosion<br>○ for erosion<br>○ for fouling<br>–Checks provision for tube expansion:<br>○ descales<br>○ replaces tubes<br>○ plugs tubes<br>○ secures tube tightness in tube plates<br>○ checks means of reducing corrosion<br>○ fills and tests<br><br>**Diesel Engine**<br>**(Supervised student activity)**<br>–Dismantles and inspects all parts for wear and deterioration, including: | |

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|---|---|---|---|
| Maintenance and repair of shipboard machinery equipment (cont.) | Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment (Reduced number of hours, also covered by the Cadetship period) (cont.) | ○ pistons<br>○ rings<br>○ liners<br>○ bearings<br>○ valves<br>○ cooling passages<br>○ crankshaft alignment<br>○ lubrication system<br>– Refurbishes Diesel Engine Components<br>○ cylinder heads<br>○ exhaust valves<br>○ air-start valves<br>○ fuel injector<br>○ relief valve<br>○ fuel injection pump<br>– Reassembles<br>– Checks timing and ascertains freedom of movement<br>– Checks condition of lubrication oil<br>– Purges air from fuel system<br>– Test runs<br><br>**Turbocharger**<br>**(Supervised Student Activity)**<br>– Dismantles:<br>○ air filter<br>○ air casing<br>○ inducer(if fitted)<br>○ impeller<br>○ volute<br>○ diffuser<br>○ gas inlet grid<br>○ nozzle ring<br>○ rotor<br>○ bearings<br>–Examines all parts for wear and deterioration, paying particular attention to:<br>○ erosion in the air side | |

| COMPETENCE | KNOWLEDGE, UNDERSTANDING AND PROFICIENCY | PERFORMANCE | APPROX HOURS |
|---|---|---|---|
| Maintenance and repair of shipboard machinery equipment (cont.) | Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment (Reduced number of hours, also covered by the Cadetship period) (cont.) | ○ erosion in the turbine nozzles and in the blades<br>○ corrosion of the gas casing<br>○ hard deposits<br>○ condition of bearings<br>○ condition of labyrinths<br>○ lubrication system<br>– Reassembles and checks clearances<br><br>**Boiler**<br><br>– Explains the need for cleaning the fire side of a boiler and how to do it<br>– Describes how to inspect the fire side of a boiler and repair/maintenance<br>– Explains the need of cleaning up the water side of a boiler and how to do it<br>– Describes how to inspect the water side of a boiler and the repair/maintenance<br>– Describes how to restore the boiler after cleaning up the fire/water side<br>– Describes how to repair the firebrick wall of a furnace<br><br>**Shafting System**<br>**(Supervised Student Activity)**<br>– Thrust block<br>– Stern tube<br>– Shaft bearings<br>– Shaft sealing equipment<br><br>**Refrigerator**<br>**(Supervised Student Activity)**<br>– Compressors<br>– Evaporator<br>– Condenser<br>– Expansion valve<br>– Oil separator<br><br>**Oils Fuels and Lubricating System**<br>**(Supervised Student Activity)** | |

| COMPETENCE | KNOWLEDGE, UNDERSTANDING AND PROFICIENCY | PERFORMANCE | APPROX HOURS |
|---|---|---|---|
| Maintenance and repair of shipboard machinery equipment (cont.) | Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment (Reduced number of hours, also covered by the Cadetship period) (cont.) | – Filters<br>– Purifiers<br>– Bearings<br>– Settling-tanks<br>– Tank contents gauges<br><br>**Deck Machinery**<br>**(Supervised Student Activity)**<br>– Lifeboat davits and gear<br>– Mooring winch<br>– Windlass<br>– Winch<br>– Crane | |
| Maintenance and Repair of Shipboard Machinery equipment | The use of appropriate specialized tools and measuring instruments | – States that some machinery/equipment are installed with specialized tools and measuring instruments for their repair and maintenance<br>– Explains what sort of specialized tools and measuring instruments are supplied<br>– Explains how to use specific specialized tools and measuring instruments showing for overhauling diesel engine and steam turbine<br>– Explains how to use wear gauge for stern tube bearing | 5 hrs |
| Manage safe and effective maintenance and repair procedures (ML) | Marine Engineering Practise ( theoretical knowledge)<br>ML | **Discusses the preparation and use of planned maintenance systems (PMS) as per ISM code**.<br>o Objective of PMS<br>o Equipment covered under PMS<br>o Critical equipment<br>o Preparation of vessel specific PMS<br>o Maintenance schedule and job procedures<br>o Updating of maintenance schedule<br>o Spare parts inventory<br>o Recording of defects | 5 hrs |

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|---|---|---|---|
| Contribute to the operation of equipment and Machinery (III-5) | Safe operation of equipment, including: hoists and lifting equipment | Safe operation of equipment including:<br>hoist and lifting equipment | 4 hrs |
| Contribute to the operation of equipment and Machinery (III-5) | Ability to use and understand basic crane, winch and hoist signals | Hatches, water tight doors, ports and related equipments | 2 hrs |
| | | Total No. of Hours | 86 Hours |

* discrepancy between course specifications and course map total hour is intended for assessment